Increasing Diabetes Self-Management Education in Community Settings

A Systematic Review

Susan L. Norris, MD, MPH, Phyllis J. Nichols, MPH, Carl J. Caspersen, PhD, MPH, Russell E. Glasgow, PhD, Michael M. Engelgau, MD, MSc, Leonard Jack Jr, PhD, MSc, Susan R. Snyder, PhD, Vilma G. Carande-Kulis, PhD, George Isham, MD, Sanford Garfield, PhD, Peter Briss, MD, David McCulloch, MD, and the Task Force on Community Preventive Services

Overview: This report presents the results of a systematic review of the effectiveness and economic efficiency of self-management education interventions for people with diabetes and forms the basis for recommendations by the Task Force on Community Preventive Services. Data on glycemic control provide sufficient evidence that self-management education is effective in community gathering places for adults with type 2 diabetes and in the home for adolescents with type 1 diabetes. Evidence is insufficient to assess the effectiveness of self-management education interventions at the worksite or in summer camps for either type 1 or type 2 diabetes or in the home for type 2 diabetes. Evidence is also insufficient to assess the effectiveness of educating coworkers and school personnel about diabetes.

Medical Subject Headings (MeSH): blood glucose self-monitoring, community health services, decision making, diabetes mellitus, evidence-based medicine, health education, patient education, preventive health services, public health practice, review literature, self-care, self-efficacy, self-help groups (Am J Prev Med 2002;22(4S):39–66)

Introduction

Diabetes self-management education (DSME), the process of teaching people to manage their diabetes,[1] has been considered an important part of the clinical management of diabetes since the 1930s and the work of Joslin.[2] The American Diabetes Association (ADA) recommends assessing self-management skills and knowledge of diabetes at least annually and providing or encouraging continuing education.[3] DSME is considered "the cornerstone of treatment for all people with diabetes" by the Task Force to Revise the National Standards for Diabetes Self-Management Education Programs,[1] a group representing national public health and diabetes-related organizations. This need is also recognized in objective 5-1 of *Healthy People 2010*[4]: to increase to 60% (from the 1998 baseline of 40%) the proportion of persons with diabetes who receive formal diabetes education.

The goals of DSME are to optimize metabolic control and quality of life and to prevent acute and chronic complications, while keeping costs acceptable.[5] Unfortunately, 50% to 80% of people with diabetes have significant knowledge and skill deficits[6] and mean glycated hemoglobin (GHb)[a] levels are unacceptably high both in people with type 1[7b] and type 2[8] diabetes. Furthermore, less than half of people with type 2 diabetes achieve ideal glycemic control[9] (hemoglobin A1c [HbA1c] <7.0%).[3]

The abundant literature on diabetes education and

From the Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion (Norris, Nichols, Caspersen, Engelau, Jack), and Epidemiology Program Office (Snyder, Carande-Kulis, Briss), Centers for Disease Control and Prevention, Atlanta, Georgia; AMC Cancer Research Center (Glasgow), Denver, Colorado; HealthPartners (Isham), Minneapolis, Minnesota; Diabetes Program Branch, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health (Garfield), Bethesda, Maryland; and Group Health Cooperative of Puget Sound (McCulloch), Seattle, Washington

Address correspondence and reprint requests to: Susan L. Norris MD, MPH, Centers for Disease Control and Prevention, MS K-10, 4770 Buford Highway NE, Atlanta, GA 30341. E-mail: Scn5@cdc.gov.

[a]GHb (including hemoglobin A1c [HbA1c]) describes a series of hemoglobin components formed from hemoglobin and glucose, and the blood level reflects glucose levels over the past 120 days (the life span of the red blood cell). (Source: American Diabetes Association. Tests of glycemia in diabetes. Diabetes Care 2001;24(suppl 1):S80–S82.)

[b]Type 1 diabetes, previously called insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, accounts for 5% to 10% of all diagnosed cases of diabetes and is believed to have an autoimmune and genetic basis. Type 2 diabetes was previously called non–insulin-dependent diabetes mellitus (NIDDM), or adult-onset diabetes. Risk factors for type 2 include obesity, family history, history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. (Source: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. National diabetes fact sheet. 1998. Available at: www.cdc.gov/diabetes/pubs/facts98.htm. Accessed 1/10/2002).

 PII S0749-3797(02)00424-5

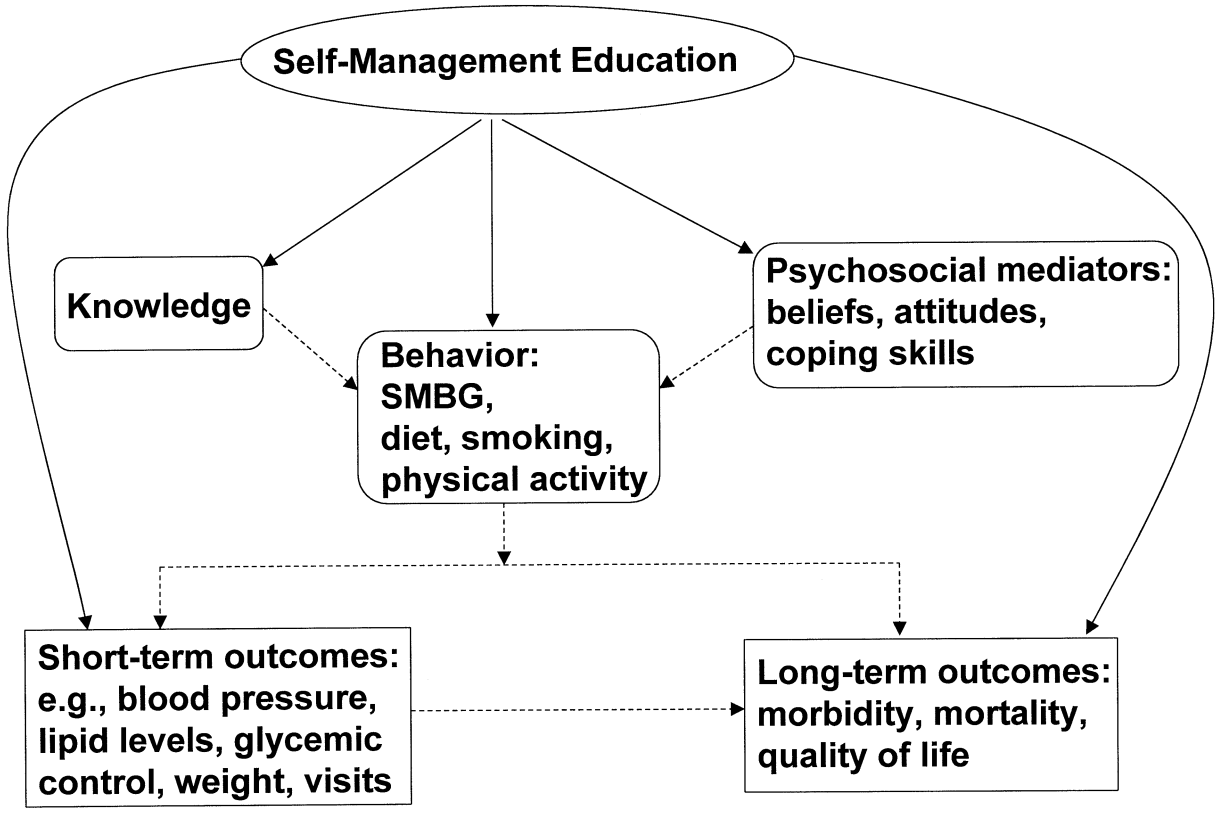

Figure 1. Analytic framework for diabetes self-management education interventions. Ovals denote interventions, rectangles with rounded corners denote short-term outcomes, and rectangles with squared corners denote long-term outcomes.
SMBG, self-monitoring of blood glucose. Solid lines represent linkages examined in this review. Dashed lines represent linkages that were not examined, where the authors relied on the existing literature to demonstrate relationships.

its effectiveness includes several important reviews demonstrating positive effects of DSME on a variety of outcomes, particularly at short-term follow-up.[6,10–14] These reviews, however, and most of the existing literature, focus primarily on the clinical setting.

The systematic review presented here includes published studies that evaluated the effectiveness of DSME delivered outside of traditional clinical settings, in community centers, faith institutions and other community gathering places, the home, the worksite, recreational camps, and schools. This review does not examine evidence of the effectiveness of clinical care interventions for the individual patient; recommendations on clinical care may be obtained from the ADA,[15] and screening recommendations are available from the U.S. Preventive Services Task Force.[16] The focus of this review is on people who have diabetes; primary prevention of diabetes is not addressed. For prevention of type 2 diabetes, the best strategies are weight control and adequate physical activity among people at high risk, including those with impaired glucose tolerance.[17,18] These topics will be addressed in other systematic reviews in the *Guide to Community Preventive Services* (the *Community Guide*).

The *Guide to Community Preventive Services*

The systematic review in this report represents the work of the independent, nonfederal Task Force on Community Preventive Services (the Task Force), as described elsewhere.[19,20] A supplement to the *American Journal of Preventive Medicine*, "Introducing the *Guide to Community Preventive Services*: Methods, First Recommendations and Expert Commentary," published in January 2000,[21] includes the background and methods used in developing the *Community Guide*.

Methods

A detailed description of the *Community Guide*'s methods for conducting systematic reviews and linking evidence to determinations of effectiveness has been published,[22] and a brief description is available in this supplement.[19] Our conceptual approach to DSME is shown in the analytic framework (Figure 1), which portrays the relationships between the intervention, intermediate outcomes (knowledge, psychosocial mediators, and behaviors), and short- and long-term health and quality of life outcomes. DSME and education interventions can certainly improve knowledge levels,[10,11,13] although the relationship between knowledge and behavior is unclear.[13,23,24] For optimal self-management, a minimum

Table 1. Outcomes reviewed for diabetes self-management education interventions

Intermediate (process) outcomes	Short-term outcomes	Long-term outcomes
Knowledge	**Glycemic control**	**Macrovascular complications**
	Glycated hemoglobin	**Peripheral vascular disease**
Skills	**Blood glucose**	**Coronary heart disease**
Problem-solving skills		**Cerebrovascular disease**
Self-monitoring of blood glucose	**Physiologic outcomes**	
Medication administration (including insulin)	**Weight**	**Microvascular complications**
	Lipid levels	**Decreased vision**
Psychosocial outcomes	**Foot lesions**	**Peripheral neuropathy**
Self-efficacy	**Blood pressure**	**Renal disease**
Health beliefs	**Microalbuminuria**	**Periodontal disease**
Mood	**Retinopathy**	**Foot lesions, amputations**
Attitude		
Coping skills	**Lifestyle**	**Mortality**
Self-assessed health status	**Physical activity**	
Locus of control	**Diet**	**Quality of life**
Perceived barriers to adherence	**Smoking**	**Disability/function**
Healthcare system outcomes	**Mental health outcomes**	Economic outcomes
Regular source of care	**Depression**	Outpatient utilization
Regular visits	**Anxiety**	Hospitalization rates
Availability of patient education		Cost
Medication adherence	Work-related outcomes	Cost-effectiveness and cost-benefit
Screening foot and eye exams	Work days lost	
Monitoring of glycemic control	Restricted duty days	Pregnancy-related outcomes
Monitoring of CVD risk factors		Neonatal morbidity and mortality
		Maternal morbidity

Outcomes in bold are those on which the Task Force based its recommendations.
CVD, cardiovascular disease.

threshold of knowledge is probably required.[25] Several psychosocial mediators are related to diabetes self-care behavior, including locus of control,[26] coping styles,[26] health beliefs,[26,27] and self-efficacy.[28]

Self-care behaviors and lifestyle correlate with short-term health outcomes. Self-monitoring of blood glucose (SMBG) is recommended by the ADA for all people with type 1 diabetes and for insulin-treated type 2 patients.[29] SMBG, which may be associated with improved health outcomes in type 1 diabetes,[30] was a critical component of the Diabetes Control and Complications Trial (DCCT)[31] and the Kumamoto study,[32,33] which demonstrated that tight glycemic control improves microvascular outcomes in type 1 and type 2 diabetes, respectively. Reductions of caloric and fat intake are associated with weight control and improved glycemic control,[34–37] and physical activity is associated with improved glycemic control.[38] Aspirin use, which offers the same cardiovascular protection for people with and without diabetes,[39] is recommended for all people with diabetes aged ≥30 years in the absence of contraindications.[39] Smoking increases morbidity and mortality from microvascular and macrovascular complications of diabetes.[40]

The short-term outcomes of hyperglycemia,[31,41] elevated blood pressure[42,43] and lipid concentrations,[44,45] proteinuria,[46] increased weight,[37] and the presence of foot lesions[47] are all associated with long-term health outcomes in people with diabetes. Thus, the evaluation of interventions in this review focuses on key intermediate, short-, and long-term health outcomes as well as quality of life and healthcare utilization (Table 1). Recommendations formulated by the Task Force[20] are based on the subset of outcomes that focus on short- and long-term health and quality of life (Table 1).

Data Sources

The medical literature was searched through December 2000 by using the MEDLINE database of the National Library of Medicine (commenced in 1966), the Educational Resources Information Center database (ERIC, 1966), the Cumulative Index to Nursing and Allied Health database (CINAHL, 1982), Healthstar (1975), Chronic Disease Prevention database (CDP, health promotion and education subfile, 1977), and the Combined Health Information Database (CHID, diabetes subfile and health promotion and education subfile, 1985). The medical subject headings (MeSH) searched (including all subheadings) were *diabetes mellitus* and *diabetes educators* combined with any of the following headings: community, community health services, patient education, health education, self-care, self-efficacy, self-help groups, blood glucose self-monitoring, and public health. Text word searches were performed by using the following terms: community, self-care, self-manag* (wildcard search), self-help groups, blood glucose self-monitoring, and patient counseling. Abstracts were not included, as they generally had insufficient information to assess the validity of the study according to *Community Guide* criteria.[22] Dissertations were also excluded, as the available abstracts contained insufficient information for evaluation, and the full text was frequently unavailable. Titles and abstracts of articles extracted by the search were reviewed for relevance, and if potentially relevant the full-text article was retrieved. We reviewed reference lists of included articles and consulted our team of experts (the authors and the consultants listed in the Acknowledgments) for relevant citations.

Study Selection

To be included in the reviews of effectiveness, studies had to be (1) primary investigations of interventions selected for evaluation, (2) published in English, and (3) conducted in established market economies.[c] They also had to (4) provide information on one or more outcomes of interest preselected by the team and (5) meet minimum quality standards.[22] All types of comparative study designs were reviewed, including studies with concurrent or before-and-after comparison groups.

Data Abstraction and Synthesis

Each study that met the inclusion criteria was evaluated by using a standardized abstraction form and was assessed for study design suitability and threats to internal validity, as described previously.[22] Studies were characterized by the number of threats to validity as having good, fair, or limited quality of execution,[22] and only those with good or fair execution were included. A summary effect measure (i.e., the difference between the intervention and comparison groups) was calculated for outcomes of interest. Absolute and relative differences are presented for outcomes with consistent measurement scales (e.g., HbA1c and blood pressure) and relative differences for outcomes with variable measurement scales (e.g., knowledge). Interquartile ranges were determined as an index of variability when seven or more studies were available in the body of evidence; otherwise ranges are presented. Pooled estimates of effect were calculated if there was a sufficient number of studies with comparable outcomes and if exploratory data analysis revealed potentially diverse results in the body of literature, or if confidence intervals frequently overlapped zero. Point estimates of effect on GHb were calculated with both fixed and random effects models, using the inverse of the variance of the net change in GHb as the study weight. Computation of the between-study variance for the random effects model was obtained by using the DerSimonian and Laird formula,[48] using estimates of within-group correlation (rho) of 0.25, 0.5, and 0.75. The chi-squared value for heterogeneity (Q) and its p value were calculated. The pooled estimates presented are from random effects models, with rho=0.75, and 95% confidence intervals.

The *Community Guide* rules of evidence characterize effectiveness as strong, sufficient, or insufficient on the basis of the number of available studies, the suitability of study designs for evaluating effectiveness, the quality of execution, the consistency of the results, and the effect sizes.[22]

Summarizing Other Effects, Barriers, Applicability, Economic Efficiency, and Research Gaps

Other effects, barriers, applicability, and research gaps were assessed in the same body of evidence used to assess effectiveness, along with input from our systematic review development team (see author list). Additional information on other positive and negative effects and applicability is described for each intervention, and economic efficiency and barriers to implementation are described for interventions for which there was sufficient evidence to formulate recommendations. Further details are provided elsewhere in this supplement,[19] and the methods for the economic evaluations in the *Community Guide* were previously published.[49]

[c]Established Market Economies, as defined by the World Bank, are Andorra, Australia, Austria, Belgium, Bermuda, Canada, Channel Islands, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Greenland, Holy See, Iceland, Ireland, Isle of Man, Italy, Japan, Liechtenstein, Luxembourg, Monaco, the Netherlands, New Zealand, Norway, Portugal, San Marino, Spain, St. Pierre and Miquelon, Sweden, Switzerland, the United Kingdom, and the United States.

Reviews of Evidence

Evidence of the effectiveness of DSME was reviewed in four settings: community gathering places, the home, recreational camps, and the worksite. The effectiveness of educating coworkers and school personnel about diabetes was also reviewed. The effectiveness of interventions for type 1 and type 2 diabetes was examined separately, as the education of children and adolescents (who usually have type 1 diabetes) is very different from the education of adults (who usually have type 2 diabetes). Children face different social pressures and have parental involvement; education theory and methods are different for children and adults; and people with type 1 diabetes are insulin-dependent, unlike most of those with type 2 disease, resulting in differences in management.

Community Gathering Places

This review encompasses DSME interventions in which people with diabetes aged 18 years and older were educated in settings outside the home, clinic, school, or worksite, such as community centers, libraries, private facilities (e.g., residential cardiovascular risk reduction centers), and faith institutions. Traditional clinical settings may not be ideal for DSME, the home setting is conducive only to individual and family teaching, and the worksite is only applicable to people who work outside the home. Thus, DSME in community gathering places may reach populations who would not normally receive this education. Church-based health education and screening programs have been shown to be effective in facilitating behavior changes among African Americans,[50] particularly women aged 65 years and older.[51] Community interventions often offer the benefit of cultural relevancy, as different cultures have diverse learning styles that may be better addressed in the community setting, and the use of appropriate educational techniques may increase the relevance and acceptance of diabetes education.[52] Interventions in community gathering places also may be more convenient, especially for those residing in rural areas, and may, thus, promote attendance.

Effectiveness. Our search identified 11 studies (in 14 reports)[53–66] that evaluated the effectiveness of DSME in community gathering places (Figure 2). One study[64] was excluded because it lacked relevant outcomes, and two[65,66] were excluded because of limited quality. De-

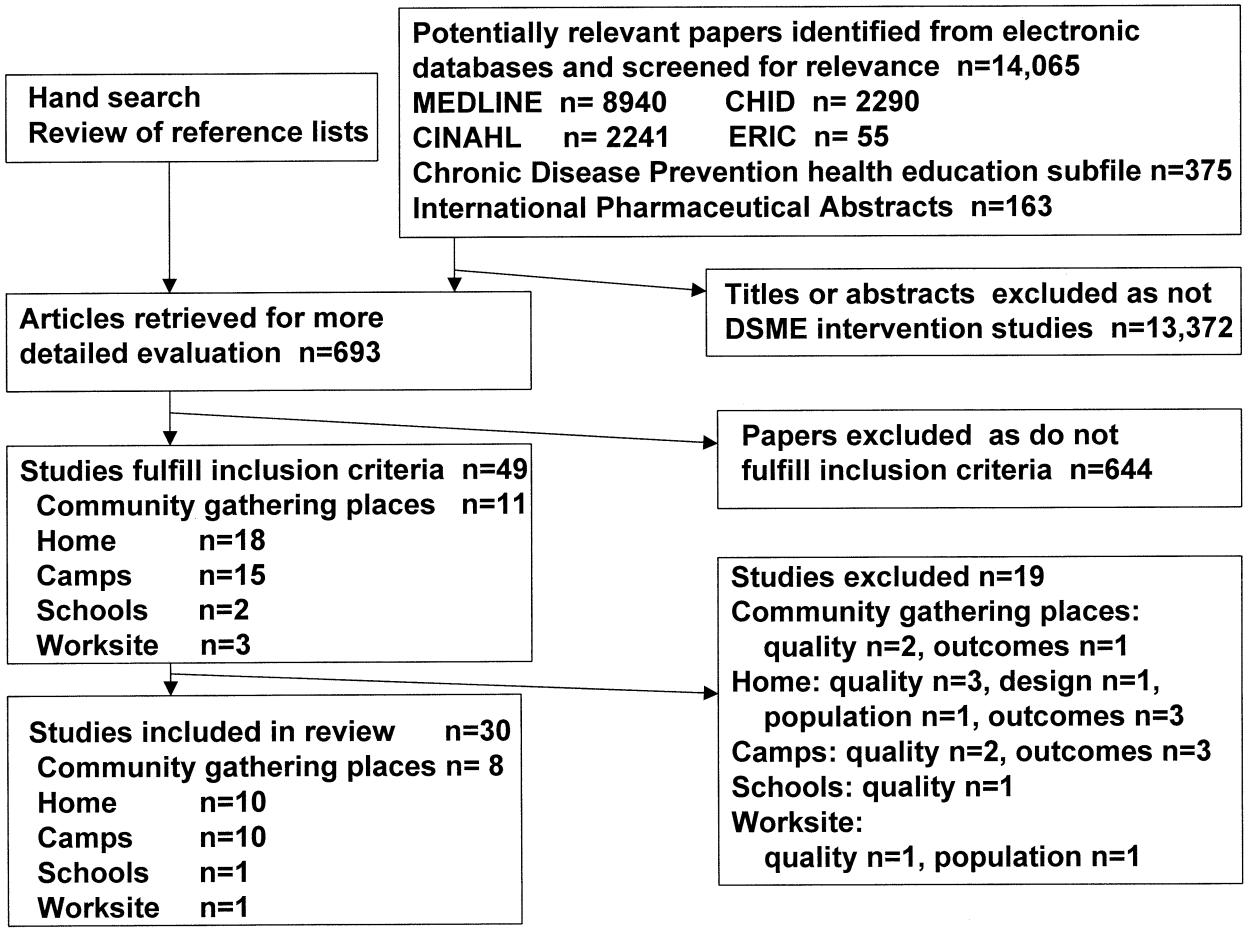

Figure 2. Flow diagram of the literature review. Studies were excluded for inadequate quality ("quality"), before-and-after design ("design"), and lack of relevant outcomes ("outcomes"), as well as if a minority of the study population had diabetes ("population").
CHID, Combined Health Information Database; CINAHL, Cumulative Index to Nursing and Allied Health; ERIC, Educational Resources Information Center; DSME, diabetes self-management education; n, number of studies.

tails of the eight qualifying studies (in 11 reports)[53–63] are provided in Appendix A and at the website (www.thecommunityguide.org).

The qualifying studies evaluated a variety of outcomes: one[53] examined changes in knowledge, one[62] physical activity, one[57] dietary intake, six (in eight reports)[53–55,57,60–63] changes in weight, two[59,63] blood pressure changes, three[53,58,63] changes in lipid concentrations, four[63] fasting blood glucose,[53–55]and four[53–55,58] GHb levels.

Evidence of effectiveness provided by the eight studies[53–63] included in our review is presented in Table 2. On the basis of the outcome of glycemic control, sufficient evidence of effectiveness was available to recommend DSME in community gathering places. In contrast, evidence of the effectiveness of this intervention was insufficient for the outcomes of dietary intake, physical activity, weight, blood pressure, and lipid levels, as there were few studies and effects were inconsistent.

Applicability. The mean age of the study populations ranged from 43 to 71 years in the seven studies that reported age.[53–57,59–63] Seven studies (in ten reports)[53–57,59–63] examined both male and female populations, and one study[58] did not report gender. Racial and ethnic backgrounds were reported in five studies: Native American (two studies, three reports)[55,56,59] and Mexican American (three studies).[53,54,57] In the six studies that reported type of diabetes, the populations were exclusively people with type 2 diabetes.[53–55,57,60,63] Baseline mean GHb levels were high, with a mean of 12.3% (range, 11.7% to 15.8%). The population in six studies (nine reports)[55–63] consisted of self-selected volunteers, with randomly selected populations in the other two.[53,54] All eight studies[53–63] were performed in the United States, three (four reports) in rural areas.[53–56] The interventions took place in a variety of settings: faith-based institutions (two studies),[57,58] community centers (five studies, seven reports),[53–56,59–61] and a Pritikin residential treatment center (one

Table 2. Effectiveness of self-management education interventions in diabetes

Intervention (no. of studies)	Description	Physiologic outcomes	Knowledge, psychosocial, behavioral, and healthcare utilization outcomes
Self-management education in community gathering places (n=8)	DSME for people aged ≥18 years in settings outside the home, clinic, school, or worksite; includes community centers, libraries, private (nonclinical) facilities, and faith institutions Median follow-up for studies that examined GHb: 6 months	**GHb** (%) (n=4) pooled estimate −1.9, (95% CI:−2.4, −1.4)[53–55,58] **Fasting blood glucose** (mmol/L) (n=4) −2.0 (−1.3 to −4.0)[53–55,63] **Weight** (lbs) (n=6) −5.2 (−9.0 to +1.6)[53–55,57,60–63] **Blood pressure** (mmHg) (n=2) systolic −12.3 and −8.6; diastolic −5.2 and −1.0[59,63] **Total cholesterol** (mg/dL) (n=3) −2.6 (−54.0 to +6.0)[53,58,63]; LDL −35.0 and +7.0[58,63]; Triglycerides −39.0 and −20.0[53,63]	**Knowledge** (n=1) improved (p=0.04)[53] **Physical activity** (minutes of walking) (n=1) improved (p<0.001)[62] **Dietary intake** (Kcal/day) (n=1) NS increase in men, NS decrease in women[57]
Self-management education in the home (n=10)	DSME occurring primarily in the home (home visits, computer-assisted instruction, and electronic communication with healthcare professionals) Median follow-up for studies that examined glycemic control: Type 1 diabetes: 12 months Type 2 diabetes: 12 months	**GHb** Type 1: (n=4) pooled estimate −1.1 (95% CI: −1.6, −0.6)[69,74,75,77] Type 2: (n=2) pooled estimate −0.5 (95% CI: −1.1, 0.1)[71,76] **Blood glucose** (mg/dL) (n=1) −49.7, p>0.05[70] **Weight** (kg) (n=3) −2.3 −4.5 to 0)[71,75,76] **Foot appearance** (n=1) (score, % difference) +1.9, p>0.05[72]	**Knowledge** (n=5) improved for type 2[72] and mixed type 1 and 2,[75] NS change for type 1[69,74,77] **Self-care skills** (n=2) improved for type 2 diabetes[70,72] **Self-concept** (n=1) improved for type 1 diabetes (NS)[69] **Healthcare utilization** % of patients with eye examination in prior 6 months (n=1) improved (OR=4.3)[68] Number of urgent care visits per person (n=2) NS decrease[69,72] Postpartum admissions for glucose control (n=1) decreased (p=0.048)[73] **Perinatal outcomes** Birth weight (gm) (n=1) NS increase[73] Gestational age (weeks) (n=1) NS increase[73] Quality of life (n=1) NS change (no statistics)[71]

(continued on next page)

Table 2. Effectiveness of self-management education interventions in diabetes (continued)

Intervention (no. of studies)	Description	Physiologic outcomes	Knowledge, psychosocial, behavioral, and healthcare utilization outcomes
Self-management education in camps (n=10)	DSME delivered in the setting of recreational camps Median follow-up: 4–6 days	**GHb** (%) (n=2) −1.8% and +0.3%[98,99] **Glycated albumin** (n=1; 2 cohorts) −2.0% and −2.7%[94]	**Knowledge** (n=7) Improved in 4 studies,[90,93–95] NS improvement in 3 studies[91,92,96] **Psychosocial mediators** Problem solving (n=1) Improved among 12- to 15-year-olds ($p<0.002$) NS improvement among 10- to 11-year-olds[93] Coping strategies (n=1) NS improvement[97] Self-concept (n=1) NS improvement[96]
Self-management education at the worksite (n=1)	DSME delivered at the worksite, or education of coworkers about diabetes	**GHb** (%) (n=1) −1.4%[111]	None reported
Education of school personnel about diabetes (n=1)	Educated school personnel about diabetes; focused on the teacher or other school staff, but outcomes could be measured either in the staff or in the student with diabetes Follow-up: 6–8 weeks	None reported	**Teacher knowledge** Of hypoglycemic symptoms (n=1) improved ($p<0.001$)[114] Of hyperglycemic symptoms (n=1) NS improvement[114]

Results presented are median absolute effect size (range) unless otherwise specified.
CI, confidence interval; DSME, diabetes self-management education; GHb, glycated hemoglobin; NS, nonsignificant; OR, odds ratio

study).[62] Interventions focused on a variety of issues: general diabetes education and self-care,[53,59] diet,[57,58,60,61] physical activity,[55] and diet combined with physical activity.[54,63] The interventions in three studies[53,59,67] were coordinated with primary care providers, but the nature and extent of clinical care was unclear. The body of evidence assessed in our review involved a wide range of attrition rates among participants (0% to 79%); in four studies[53,54,57,58] these rates exceeded 20%, and no study compared dropouts to completers.

In summary, the available literature is applicable to adults with type 2 diabetes with a range of racial and ethnic backgrounds and in a variety of settings. Applicability is limited, however, by the self-selected nature of the study populations, their high attrition rates, and high baseline GHb levels.

Other positive or negative effects. A possible lack of quality control and accountability could negatively affect the quality of programs in community settings, although no studies in this body of evidence examined this issue.

Economic. No studies were found that met the requirements for inclusion in a *Community Guide* review.[49]

Barriers to implementation. The systematic review development team felt that there were several potential barriers to these interventions, although this body of evidence did not evaluate them. It may be difficult to identify people to attend DSME interventions in community settings. In the literature to date, participants have been largely self-selected, and more general recruitment may be difficult. Coordinating these interventions with the patient's primary care team may also be problematic.

Conclusion. According to *Community Guide* rules of evidence,[22] there is sufficient evidence that DSME is effective in community gathering places for adults with type 2 diabetes with a broad range of ages and ethnic or racial backgrounds. Applicability is limited, however, by the self-selected nature of the study populations, their high attrition rates, and their high baseline GHb levels. The interventions rarely reported coordination with the patients' clinical care provider, and the nature and extent of care in the clinical setting was unclear. DSME for adults delivered in community gathering places should be coordinated with the person's primary care provider, and these interventions should not be considered a replacement for education in the clinical setting until adequate coordination is established.

Directions for future research. More studies are needed to examine the effectiveness of DSME interventions in community gathering places. Which settings are optimal? What is the best way to recruit people with diabetes to these interventions? Who is the ideal provider in these settings? What is the optimal intensity and duration of interventions in community gathering places? What type of maintenance-phase interventions are best? How do DSME interventions in community gathering places compare with those delivered in the clinical setting with respect to effectiveness, ease of implementation, barriers, long-term maintenance capabilities, and cost-effectiveness? Which characteristics of community gathering places affect adoption and outcomes of DSME interventions? How are these interventions best coordinated with primary care? Are there racial or ethnic groups that perceive a relatively greater need for DSME in alternative settings? Are there racial or ethnic groups that may benefit more from community interventions compared with interventions delivered in the clinic setting?

The Home

In most home-based interventions, educators come to the home of the person with diabetes and assess and address issues that may not be apparent or may be more difficult to manage in the clinical setting. These issues include cultural, family, and environmental factors affecting lifestyle (particularly diet and physical activity), problem solving, self-monitoring of blood glucose, glycemic control, and the prevention and management of complications.

Effectiveness. Our search identified 18 studies that evaluated the effectiveness of DSME interventions in the home (Figure 2).[68–86] Three studies[78,79,86] were excluded for quality limitations, one[80] for design limitations (a before-and-after design), three[81–83] for lack of relevant outcomes, and one[85] because only a small minority of the study population had diabetes. Ten studies,[68–77] all randomized controlled trials, were included in our review (see Appendix A or the website, www.thecommunityguide.org).

These ten studies examined a variety of outcomes: knowledge (five studies),[69,72,74,75,77] self-care skills (two studies),[70,72] self-concept (one study),[69] healthcare utilization (four studies),[68,69,72,73] birthweight and gestational age (one study),[73] quality of life (one study),[71] weight (three studies),[71,75,76] foot appearance (one study),[72] blood glucose (one study),[70] and GHb levels (six studies).[69,71,74–77]

Evidence of effectiveness provided by the ten studies is presented in Table 2. The six studies examining GHb levels[69,71,74–77] were stratified by type of diabetes. Evidence of the effectiveness of home interventions on glycemic control was sufficient for adolescents with type 1 diabetes but not for adults with type 2 diabetes. Evidence of the effectiveness of DSME in the home was insufficient for both type 1 and type 2 diabetes when other psychosocial, behavioral, or health outcomes were examined.

Applicability. The three studies of children and adolescents with type 1 diabetes were performed in the United States,[69] Canada,[77] and Australia.[74] The study populations had a mean age of 9 to 14 years, were of mixed gender, and race or ethnicity was not reported for them. In summary, there is evidence that DSME is effective in the home for children and adolescents of either gender with type 1 diabetes.

Seven studies involved adult populations (mean age 27 to 63 years) with type 2 diabetes,[70,71] gestational diabetes,[73] mixed type 1 and type 2 diabetes,[75,76] or no clear information on the type of diabetes.[68,72] These studies of racially mixed adult populations were conducted in both the United States and Europe.

Other positive or negative effects. The systematic review development team identified other potential effects of DSME in the home, and further evaluation is needed to determine if these effects are significant. DSME in the home could increase the involvement and support of the family and thereby improve lifestyle, knowledge levels, and social support for people with diabetes. Providing DSME in the home may also lead to positive changes in diet and physical activity for family members, which may assist the maintenance of these behaviors in the person with diabetes and prevent development of diabetes in relatives. DSME at home may be especially helpful for people who have difficulty visiting a clinic. No harms of this intervention were identified in the literature or by the systematic review development team.

Economic. A study at the Montreal Children's Hospital in Canada[87] reported the average cost of intensive home care, including insulin adjustment and DSME, for a group of children aged 2 to 17 years. After diagnosis and hospitalization to stabilize their metabolic condition, home-care patients were discharged, whereas traditional-care patients remained hospitalized for insulin adjustment and DSME. Education content was similar in the two settings. The home-care intervention consisted of visits by a specially trained nurse who was also available by telephone and an extra clinic visit after discharge. Costs measured included those for health system resources (hospital supplies, services, and nonphysician staff time, as well as physician and counseling services) and parent out-of-pocket and time costs for 24 months. Costs not included were an identical family monthly government allowance for insulin and medical supplies, diabetes-related health services not provided by the hospital, and overhead, as well as residents' and interns' services at the hospital. The average program costs for the home intervention (adjusted to the *Community Guide* reference case) were $50 per child more than for traditional-care patients (a nonsignificant difference between groups). Mean GHb levels were 10% lower for the home-care patients at 24 and 36 months. The two groups differed little in the use of hospital and physician services during the 24 months. This study was classified as very good by *Community Guide* quality assessment criteria.[49]

Barriers to implementation. The systematic review development team felt that there were several potential barriers to implementation. It may be difficult to identify people who would benefit from DSME in the home. These patients may rarely be seen in a clinic and, thus, would not be well known to the healthcare team. Similarly, in the clinic it may be difficult to determine which patients have barriers to self-management related to their family and living situation.

Conclusion. According to *Community Guide* rules of evidence,[22] evidence is sufficient that DSME in the home is effective in improving glycemic control for children and adolescents with type 1 diabetes. The body of evidence was insufficient to assess the effectiveness of this intervention on glycemic control or other outcomes for people with type 2 diabetes.

Directions for future research. The most effective components of DSME in the home, the optimal intensity and duration of the interventions, and the best person to deliver these interventions all need to be identified. The effectiveness of these interventions as measured by intermediate outcomes (including changes in diet and physical activity, social support, and self-efficacy), health outcomes (including weight, lipid levels, and blood pressure), and quality of life needs to be determined. Whether educating the person with diabetes in the home has health benefits for the family also needs to be examined. Additionally, the effectiveness of these interventions among adults with type 2 diabetes, particularly the elderly (>65 years), should be addressed. The effectiveness of these interventions in various racial and socioeconomic groups needs to be determined, as these data are rarely reported in this literature. Perceived barriers to implementing DSME in the home also need to be identified, as does the best way to identify people who would benefit from an intervention in the home. Finally, how these interventions are best linked to primary care and to disease management strategies needs to be determined.

Recreational Camps

DSME in recreational camps has been described frequently, with the literature focusing exclusively on summer camps for children and adolescents with type 1 diabetes. Children with type 1 diabetes need to follow the same regimen of care year-round, and summer is often a challenging time for these children and their parents. With diverse outdoor activities and inconsistent routines, children may find it difficult to follow their schedule of daily monitoring, injections, and specific meal plans, or they may simply lose interest in doing so. To accommodate children and adolescents,

the first residential summer camp for children with diabetes was established in 1925.[88] The camp's mission was to allow these children a camping experience in a safe environment while enabling them to share their experiences and learn to be more personally responsible for the care of their disease.[89] Recreational camps are now frequently used for DSME of children and adolescents, and in the United States more than 90 camps serve more than 10,000 people with diabetes.[88] In the camp setting, the recreational, educational, social, and healthcare needs of children can be met in a safe, enjoyable, and productive environment. DSME can be readily integrated into daily routines, compliance with educational and medical treatment can be optimized, food intake is controlled, medical expertise is usually readily available, and children can safely pursue physical activity.

Effectiveness. Our search identified 15 studies in which the effectiveness of DSME interventions in recreational camps was evaluated (Figure 2).[90–104] Of these studies, two were excluded for inadequate quality[100,101] and three for lack of relevant outcomes.[102–104] Ten studies were of good or fair quality of execution and were included in our review[90–99] (see Appendix A or the website, www.thecommunityguide.org).

The ten studies examined a variety of outcomes: patient knowledge (seven studies),[90–96] psychosocial attributes (three studies),[93,96,97] and glycemic control (three studies).[94,98,99] Evidence of the effectiveness of these interventions is presented in Table 2. GHb levels improved in one[98] of two studies in which this outcome was measured, and glycated albumin improved in a third study.[94] Knowledge increased significantly in four studies[90,93–95] and psychosocial mediators in three.[93,96,97]

Applicability. The age of study participants ranged from 8 to 15 years, and all had type 1 diabetes. Seven studies[90,91,93,95,97–99] reported participation by both boys and girls, and three studies[92,94,96] did not report gender. Three studies[97–99] consisted of an all-white population, one study[93] reported a racially mixed population, and race or ethnicity was not reported in six studies.[90–92,94–96] All the interventions were performed in the United States. The median duration of the interventions was 1.5 weeks (range, 1 to 3 weeks). All follow-up periods were either immediate (seven studies)[90–94,96,97] or 3 months or less (three studies).[95,98,99] Overall, the results of this review should be applicable to the general population of children and adolescents who have type 1 diabetes and attend a diabetes camp for less than 1 month.

Other positive or negative effects. The systematic review development team identified other potential benefits, although these were not formally evaluated in the literature reviewed. DSME in the camp setting can be combined with a recreational activity; for example, instruction about insulin adjustment could precede physical activity. Good nutrition habits can be modeled by serving nutritious meals and snacks, and peer support can foster improved self-esteem and self-efficacy. The relaxed, fun, nonclinical atmosphere of the camp setting can associate DSME with a positive experience. No harms of DSME in the camp setting were identified in the literature or by the systematic review development team.

Conclusion. According to *Community Guide* rules of evidence,[22] evidence is insufficient to assess the effectiveness of DSME in recreational camps, based on the lack of a sufficient number of quality studies examining health outcomes such as glycemic control. There was, however, sufficient evidence to demonstrate a positive effect on knowledge for children and adolescents with type 1 diabetes, which was part of the mission of the first camps established in the 1920s.[88]

Directions for future research. Further studies are needed to determine the effectiveness of DSME in recreational camps on self-efficacy and other psychosocial mediators, behavior change, and quality of life. Studies with longer follow-up intervals are also needed. Glycemic control and other physiologic outcomes are important outcomes and should be examined, but quality of life and psychosocial outcomes are probably more important for these short-term interventions. Long-term maintenance interventions need to be examined: repetitive interventions are likely needed to maintain any gains from the initial intervention. Finally, the optimal frequency of the camp experience needs to be determined.

The Worksite

The worksite presents important issues for people with diabetes. They are more likely to experience difficulty obtaining employment and staying employed than are people without diabetes,[105,106] and they experience more employer discrimination than do nondisabled employees.[107,108] The Americans with Disabilities Act, implemented in 1992, prohibits employer discrimination against qualified people with disabilities, and it requires employers to provide reasonable accommodations. A worksite intervention could target both the person with diabetes or his or her coworkers or supervisors. Workers with diabetes often find it difficult to reconcile their daily diabetes-related routines with their job requirements, making the worksite a potentially important place for DSME. Interventions at the worksite may make it easier for people with diabetes to attend, and supervisors, managers, and coworkers may gain valuable information. The supervisor and manager need to support healthy lifestyles; make allowances for meal and snack-time requirements, self-monitoring of

blood glucose, and medical appointments; and promote understanding, tolerance, and support among coworkers.

Effectiveness. Our search identified three studies[109–111] that examined the effectiveness of DSME at the worksite (Figure 2). One study[109] was excluded because only 4% of the study population had diabetes, and another[110] was excluded because of quality limitations. The third study,[111] with a before-and-after design, was included in our review (Table 2). Details of this study are presented in Appendix A and at the website (www.thecommunityguide.org).

Applicability. The one included study was performed in the United States at a large banking corporation. The mean age of the study population was 45 years, 53% of the participants were women, and participants had either type 1 or type 2 diabetes (percentages not reported). Race or ethnicity also were not reported. Applicability is limited because the study population was self-selected.

Other positive or negative effects. The systematic review development team identified other potential effects, although these effects have not yet been evaluated in the literature. Education of coworkers may increase tolerance and understanding of diabetes and other chronic diseases and can minimize disability-related discrimination. Both the employee with diabetes and the employer will benefit from increased employee productivity. Potential negative effects of educating people with diabetes at the worksite include labeling and issues of the confidentiality of health information. Educating coworkers can be associated with discomfort or fear about responding to adverse health events affecting the employee with diabetes.

Conclusion. According to *Community Guide* rules of evidence,[22] evidence is insufficient to assess the effectiveness of DSME at the worksite, as only a single study, with a before-and-after design, was identified. Evidence of the effectiveness of educating coworkers about diabetes also is insufficient, as no studies were identified.

Directions for future research. Studies are needed to determine the perceived educational needs of workers with diabetes, their supervisors, and coworkers. Studies also are needed to determine what populations of workers might benefit, what patient and coworker outcomes should be measured, and the most effective interventions for achieving desired goals.

Education of School Personnel about Diabetes

Professionals in the school setting may receive diabetes education with the ultimate goal of improving the health and well-being of children (students) with diabetes. Outcomes could be measured either in the teacher or in the student with diabetes.

Most of the approximately 125,000 children aged 19 and younger in the United States who have diabetes[112] attend school, and they need special accommodation during the school day to ensure their immediate safety, long-term physical and psychological well-being, and optimal scholastic achievement. School personnel must have sufficient knowledge about diabetes and its management because they are required by law to provide health-related services to children who demonstrate an identified need.[113] Unfortunately, the level of teacher knowledge about diabetes, especially of life-threatening emergencies such as hypoglycemia, is inadequate and poses a serious threat to the safety and well-being of children who require assistance.[114] School personnel, particularly teachers, have reported they receive inadequate or no training to prepare them for dealing with children who have health conditions.[115–117] The failure of school personnel to respond in a prompt and appropriate manner to diabetes-related emergencies at school could have significant health consequences for a child.[118]

Effectiveness. Our search identified two studies that examined the effectiveness of diabetes education interventions in schools (Figure 2).[114,119] One study was excluded[119] because of limited quality of execution; the other,[114] of least suitable design (before-and-after), was included in our review (Table 2). Details of this study are provided in Appendix A and at the website (www.thecommunityguide.org).

Applicability. The one included study[114] was performed in a public elementary school in the United States and involved 49 families. Age, gender, race, and duration of disease were not reported. The mean duration of the intervention was 25 months, with a mean follow-up of 7 weeks. Applicability of this study is limited because of the small sample size and lack of demographic information.

Other positive or negative effects. The systematic review development team identified other potential effects of this intervention, although these effects were not examined in this body of literature. Education of school personnel about diabetes may increase tolerance among teachers and student peers of disability related to other chronic conditions. Potential negative effects include labeling or ostracism of the child with diabetes, issues of confidentiality, the opportunity cost of teacher education (the use of money that could be spent on the prevention and treatment of more common health issues), and teacher anxiety associated with feeling personally responsible and potentially liable for a child's health and well-being.

Conclusion. According to *Community Guide* rules of evidence,[22] the number of quality studies is insufficient to assess the effectiveness of educating school personnel about diabetes.

Directions for future research. Further research is needed on the effectiveness of educating school personnel about diabetes. Research is needed to define the most effective interventions and who should deliver them. What is the most desirable intensity, duration, and frequency of the interventions? Is group education of personnel or individual education of a teacher with reference to a specific student preferred? A broad array of outcomes that focus on both teachers and students should be examined. For teachers these outcomes include knowledge and attitudes, self-efficacy in dealing with emergencies, coping skills, and perceived barriers, and for students these outcomes include glycemic control, weight, social support, self-efficacy, complication rates, absenteeism, academic performance, and quality of life.

Methodologic Issues

Future studies on the effectiveness of DSME interventions in community settings need to address a number of methodologic issues. First, attention must be paid to the internal validity of studies and potential sources of bias. Second, randomized controlled trials should be performed to facilitate conclusions about efficacy and causal inference. Observational studies are useful to assess effectiveness, but the study design must control for potential confounders and secular trends. Additionally, researchers should present adequate descriptive information on patient recruitment, demographics, settings, and interventions. Without this information it is difficult to determine what aspects of the intervention may lead to improved outcomes, and how to apply results to a given population and setting. Study participants were generally volunteers, and these self-selected groups likely differ from the general population. In the future, studies need to promote the reach of the intervention to encompass broad populations. Finally, reliable and valid questionnaires should be used, and adequate statistical analyses should be provided.

Conclusions

Self-management is critical to the health of the person with diabetes, and the objectives for ideal self-management interventions in diabetes are clear: behavioral interventions must be practical and feasible in a variety of settings; a large percentage of the relevant population must be willing to participate; the intervention must be effective for long-term, important physiologic outcomes as well as behavioral endpoints and quality of life; patients must be satisfied; and the intervention must be relatively low cost and cost-effective.[120] Evidence shows that DSME is effective in improving glycemic control when delivered in community gathering places for adults with type 2 diabetes and in the home for children and adolescents with type 1 diabetes. Further research is needed, however, to delineate interventions for optimizing long-term health and quality of life outcomes in these settings. Work is also needed to identify which racial, ethnic, and socioeconomic populations may benefit the most, and how best to identify and recruit these people. Effective strategies have yet to be demonstrated for DSME interventions in the settings of recreational camps and the worksite or for educating coworkers and school personnel about diabetes.

The authors thank Stephanie Zaza, MD, MPH, for support, technical assistance, and editorial review; Kristi Riccio, BSc, for technical assistance; and Kate W. Harris, BA, for editorial and technical assistance. The authors acknowledge the following consultants for their contribution to this manuscript: Tanya Agurs-Collins, PhD, Howard University Cancer Center, Washington, DC; Ann Albright, PhD, RD, California Department of Health Services, Sacramento; Pam Allweiss, MD, Lexington, KY; Elizabeth Barrett-Connor, MD, University of California, San Diego; Richard Eastman, MD, Cygnus, San Francisco, CA; Luis Escobedo, MD, New Mexico Department of Health, Las Cruces; Wilfred Fujimoto, MD, University of Washington, Seattle; Richard Kahn, PhD, American Diabetes Association, Alexandria, VA; Robert Kaplan, PhD, University of California, San Diego; Shiriki Kumanyika, PhD, University of Pennsylvania, Philadelphia; David Marrerro, PhD, Indiana University, Indianapolis; Marjorie Mau, MD, Honolulu, HI; Nicolaas Pronk, PhD, HealthPartners, Minneapolis, MN; Laverne Reid, PhD, MPH, North Carolina Central University, Durham; Yvette Roubideaux, MD, MPH, University of Arizona, Tucson.

The authors also thank Semra Aytur, MPH, Inkyung Baik, PhD, Holly Murphy MD, MPH, Cora Roelofs, ScD, and Kelly Welch, BSc, for assisting us in abstracting data from the studies included in this review.

References

1. Task Force to Revise the National Standards, The American Diabetes Association. National standards for diabetes self-management education programs. Diabetes Educ 1995;21:189–93.
2. Bartlett EE. Historical glimpses of patient education in the United States. Patient Educ Couns 1986;8:135–49.
3. American Diabetes Association. Standards of medical care for patients with diabetes mellitus. Diabetes Care 2001;24(suppl 1):S33–S55.
4. U.S. Department of Health and Human Services. Healthy people 2010, 2nd ed. Washington, DC: U.S. Government Printing Office; 2000.
5. de Weerdt I, Visser AP, van der Veen EA. Attitude behaviour theories and diabetes education programmes. Patient Educ Couns 1989;14:3–19.
6. Clement S. Diabetes self-management education. Diabetes Care 1995;18: 1204–14.
7. Rosilio M, Cotton JB, Wieliczko MC, et al. Factors associated with glycemic control. A cross-sectional nationwide study in 2,579 French children with type 1 diabetes. Diabetes Care 1998;21:1146–53.
8. Harris MI. Health care and health status and outcomes for patients with Type 2 diabetes. Diabetes Care 2000;23:754–8.
9. Harris MI, Eastman RC, Cowie CC, Flegal KM, Eberhardt MS. Racial and ethnic differences in glycemic control of adults with type 2 diabetes. Diabetes Care 1999;22:403–8.
10. Brown SA. Effects of educational interventions in diabetes care: a meta-analysis of findings. Nurs Res 1988;37:223–30.
11. Brown SA. Studies of educational interventions and outcomes in diabetic adults: a meta-analysis revisited. Patient Educ Couns 1990;16:189–215.
12. Padgett D, Mumford E, Hynes M, Carter R. Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. J Clin Epidemiol 1988;41:1007–30.

13. Norris SL, Engelgau MM, Venkat Narayan KM. Effectiveness of self-management training in type 2 diabetes: systematic review of randomized controlled trials. Diabetes Care 2001;24:561–87.
14. Hampson SE, Skinner TC, Hart J, et al. Behavioral interventions for adolescents with type 1 diabetes: how effective are they? Diabetes Care 2000;23:1416–22.
15. American Diabetes Association. American Diabetes Association: clinical practice recommendations 2001. Diabetes Care 2001;24(suppl 1):S1–S133.
16. Report of the U.S. Preventive Services Task Force. Screening for diabetes mellitus. Guide to clinical preventive services. Alexandria, VA: International Medical Publishing, 1996:193–208.
17. Helmrich JP, Ragland DR, Leung RW, Paffenbarger RS. Physical activity and reduced occurrence of non-insulin-dependent diabetes mellitus. N Engl J Med 1991;325:147–52.
18. Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. For the Finnish Diabetes Prevention Study Group. N Engl J Med 2001;344:1343–50.
19. Norris SL, Nichols PJ, Caspersen C, et al., and the Task Force on Community Preventive Services. The effectiveness of disease and case management for people with diabetes: a systematic review. Am J Prev Med 2002;22(suppl 4):15–38.
20. Task Force on Community Preventive Services. Recommendations for healthcare system and self-management education interventions to reduce morbidity and mortality from diabetes. Am J Prev Med 2002; 22(suppl 4):10–14.
21. Task Force on Community Preventive Services. Introducing the Guide to Community Preventive Services: methods, first recommendations and expert commentary. Am J Prev Med 2000;18(suppl 1):1–142.
22. Briss PA, Zaza S, Pappaioanou M, et al. Developing an evidence-based Guide to Community Preventive Services—methods. The Task Force on Community Preventive Services. Am J Prev Med 2000;18(suppl 1):35–43.
23. Bloomgarden ZT, Karmally W, Metzger MJ, et al. Randomized, controlled trial of diabetic patient education: improved knowledge without improved metabolic status. Diabetes Care 1987;10:263–72.
24. Korhonen T, Huttunen J, Aro A, et al. A controlled trial on the effects of patient education in the treatment of insulin-dependent diabetes. Diabetes Care 1983;6:256–61.
25. Lockington TJ, Farrant S, Meadow KA, Dowlatshahi D, Wise PH. Knowledge profile and control in diabetic patients. Diabet Med 1988;5:381–6.
26. Peyrot M. Behavior change in diabetes education. Diabetes Educ 1999;25 (suppl 6):62–73.
27. Wilson W, Ary DV, Biglan A, Glasgow RE, Toobert DJ, Campbell DR. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. Diabetes Care 1986; 9:614–22.
28. Grembowski D, Patrick D, Diehr P, et al. Self-efficacy and health behavior among older adults. J Health Soc Behav 1993;34:89–104.
29. American Diabetes Association. Tests of glycemia in diabetes. Diabetes Care 2001;24(suppl 1):S80–S82.
30. Evans JM, Newton RW, Ruta DA, MacDonald TM, Stevenson RJ, Morris AD. Frequency of blood glucose monitoring in relation to glycaemic control: observational study with diabetes database. Br Med J 1999;319: 83–6.
31. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med 1993;329:977–86.
32. Ohkubo Y, Kishikawa H, Araki E, et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. Diabetes Res Clin Pract 1995;28:103–17.
33. Wake N, Hisashige A, Katayama T, et al. Cost-effectiveness of intensive insulin therapy for type 2 diabetes: a 10-year follow-up of the Kumamoto study. Diabetes Res Clin Pract 2000;48:201–10.
34. Reaven GM. Beneficial effect of moderate weight loss in older patients with non-insulin-dependent diabetes mellitus poorly controlled with insulin. J Am Geriatr Soc 1985;33:93–5.
35. Wing RR, Koeske R, Epstein LH, Nowalk MP, Gooding W, Becker D. Long-term effects of modest weight loss in type II diabetic patients. Arch Intern Med 1987;147:1749–53.
36. Watts NB, Spanheimer RG, DiGirolamo M, et al. Prediction of glucose response to weight loss in patients with non-insulin-dependent diabetes mellitus. Arch Intern Med 1990;150:803–6.
37. American Diabetes Association. Nutrition recommendations and principles for people with diabetes mellitus. Diabetes Care 2001;24(suppl 1):S44–S47.
38. American Diabetes Association. Diabetes mellitus and exercise. Diabetes Care 2001;24(suppl 1):S51–S55.
39. American Diabetes Association. Aspirin therapy in diabetes. Diabetes Care 2001;24(suppl 1):S62–S63.
40. American Diabetes Association. Smoking and diabetes. Diabetes Care 2001;24(suppl 1):S64–S65.
41. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352:837–53.
42. UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. Br Med J 1998;317:703–13.
43. Bakris GL, Williams M, Dworkin L, et al. Preserving renal function in adults with hypertension and diabetes: a consensus approach. National Kidney Foundation Hypertension and Diabetes Executive Committees Working Group. Am J Kidney Dis 2000;36:646–61.
44. Fontbonne A, Eschwege E, Cambien F, et al. Hypertriglyceridemia as a risk factor of coronary heart disease mortality in subjects with impaired glucose tolerance or diabetes: results from the 11-year follow-up of the Paris Prospective Study. Diabetologia 1989;32:300–4.
45. American Diabetes Association. Management of dyslipidemia in adults with diabetes. Diabetes Care 2001;24(suppl 1):S58–S61.
46. American Diabetes Association. Diabetic nephropathy. Diabetes Care 2001;24(suppl 1):S69–S72.
47. Bild DE, Selby JV, Sinnock P, Browder WS, Braveman P, Showstack JA. Lower-extremity amputation in people with diabetes. Epidemiology and prevention. Diabetes Care 1989;12:24–31.
48. DerSimonian R, Laird N. Meta-analysis in clinical trials. Controlled Clin Trials 1986;7:177–88.
49. Carande-Kulis VG, Maciosek MV, Briss PA, et al. Methods for systematic review of economic evaluations for the Guide to Community Preventive Services. Am J Prev Med 2000;18(suppl 1):75–91.
50. Irwin C, Braithwaite R. Church-based diabetes education program for older, African-American women. Am J Health Studies 1997;13:1–7.
51. Kumanyika SK, Charleston JB. Lose weight and win: a church-based weight loss program for blood pressure control among black women. Patient Educ Couns 1992;19:19–32.
52. Carter JS, Gilliland SS, Perez GE, et al. Native American Diabetes Project: designing culturally relevant education materials. Diabetes Educ 1997;23: 133–4,139.
53. Brown SA, Hanis CL. A community-based, culturally sensitive education and group-support intervention for Mexican Americans with NIDDM: pilot study of efficacy. Diabetes Educ 1995;21:203–10.
54. Brown SA, Upchurch SL, Garcia AA, Barton SA, Hanis CL. Symptom-related self-care of Mexican Americans with type 2 diabetes: preliminary findings of the Starr County Diabetes Education Study. Diabetes Educ 1998;24:331–9.
55. Heath GW, Wilson RH, Smith J, Leonard BE. Community-based exercise and weight control: diabetes risk reduction and glycemic control in Zuni Indians. Am J Clin Nutr 1987;53(suppl 6):1642S–6S.
56. Wilson R, Hoy W. Short-term effects of participation in a community-based exercise program: a study in the pueblo of Zuni. IHS Primary Care Provider 1993;18:126–31.
57. Elshaw EB, Young EA, Saunders MJ, McGurn WC, Lopez LC. Utilizing a 24-hour dietary recall and culturally specific diabetes education in Mexican Americans with diabetes. Diabetes Educ 1994;20:228–35.
58. Hahn JM, Gordon DH. "Learn, taste, and share": a diabetes nutrition education program developed, marketed, and presented by the community. Diabetes Educ 1998;24:153–4,161.
59. Wang CY, Abbott LJ. Development of a community-based diabetes and hypertension preventive program. Public Health Nurs 1998;15:406–14.
60. Pratt C, Wilson W, Leklem J, Kingsley L. Peer support and nutrition education for older adults with diabetes. J Nutrition Elderly 1987;6:31–43.
61. Wilson W, Pratt C. The impact of diabetes education and peer support upon weight and glycemic control of elderly persons with noninsulin dependent diabetes mellitus (NIDDM). Am J Public Health 1987;77: 634–5.
62. Barnard RJ, Lattimore L, Holly RG, Cherny S, Pritikin N. Response of non-insulin-dependent diabetic patients to an intensive program of diet and exercise. Diabetes Care 1982;5:370–4.
63. Barnard RJ, Jung T, Inkeles SB. Diet and exercise in the treatment of NIDDM: the need for early emphasis. Diabetes Care 1994;17:1469–72.

64. Drainville SG, Sevier RE. One community's approach to diabetes education. N C Med J 1984;45:169–71.
65. Irvine AA, Mitchell CM. Impact of community-based diabetes education on program attenders and nonattenders. Diabetes Educ 1992;18:29–33.
66. Sullivan ED, Joseph DH. Practice point. University/community partnership to improve the lives of people with diabetes. Practical Diabetes Int 2000;17:26–30.
67. Centers for Disease Control. Community-based exercise intervention—the Zuni Diabetes Project. MMWR Morb Mortal Wkly Rep 1987;36(40):661–4.
68. Basch CE, Walker EA, Howard CJ, Shamoon H, Zybert P. The effect of health education on the rate of ophthalmic examinations among African Americans with diabetes mellitus. Am J Public Health 1999;89:1878–82.
69. Brown SJ, Lieberman DA, Germeny BA, Fan YC, Wilson DM, Pasta DJ. Educational video game for juvenile diabetes: results of a controlled trial. Med Inform 1997;22:77–89.
70. Mazzuca KB, Farris NA, Mendenhall J, Stoupa RA. Demonstrating the added value of community health nursing for clients with insulin-dependent diabetes. J Community Health Nurs 1997;14:211–24.
71. Whitlock WL, Brown A, Moore K, et al. Telemedicine improved diabetic management. Mil Med 2000;165:579–84.
72. Rettig BA, Shrauger DG, Recker RR, Gallagher TE, Wiltse H. A randomized study of the effects of a home diabetes education program. Diabetes Care 1986;9:173–8.
73. York R, Brown LP, Samuels P, et al. A randomized trial of early discharge and nurse specialist transitional follow-up care of high-risk childbearing women. Nurs Res 1997;46:254–61.
74. Couper JJ, Taylor J, Fotheringham MJ, Sawyer M. Failure to maintain the benefits of home-based intervention in adolescents with poorly controlled type 1 diabetes. Diabetes Care 1999;22:1933–7.
75. Turnin MC, Beddok RH, Clottes JP, et al. Telematic expert system Diabeto. New tool for diet self-monitoring for diabetic patients. Diabetes Care 1992;15:204–12.
76. Manning RM, Jung RT, Leese GP, Newton RW. The comparison of four weight reduction strategies aimed at overweight diabetic patients. Diabet Med 1995;12:409–15.
77. Dougherty G, Schiffrin A, White D, Soderstrom L, Sufrategui M. Home-based management can achieve intensification cost-effectively in type I diabetes. Pediatrics 1999;103:122–8.
78. Giordano B, Rosenbloom AL, Heller D, Weber FT, Gonzalez R, Grgic A. Regional services for children and youth with diabetes. Pediatrics 1977; 60:492–8.
79. Hanstine S, Fanning V. Teaching patients to manage diabetes safely in the home. Home Health Care Manage Pract 2000;12:40–8.
80. Strock E, Jacobson J, Reader D, Hollander P. Managing diabetes in the home: a model approach. Caring 1988;7:50–6.
81. Anderson RM, Fitzgerald JT, Funnell MM, et al. Evaluation of an activated patient diabetes education newsletter. Diabetes Educ 1994;20:29–34.
82. Horan PP, Yarborough MC, Besigel G, Carlson DR. Computer-assisted self-control of diabetes by adolescents. Diabetes Educ 1990;16:205–11.
83. Ledda MA, Walker EA, Basch CE. Development and formative evaluation of a foot self-care program for African Americans with diabetes. Diabetes Educ 1997;23:48–50.
84. Newcomb PA, Klein R, Massoth KM. Education to increase ophthalmologic care in older onset diabetes patients: indications from the Wisconsin Epidemiologic Study of Diabetic Retinopathy. J Diabetes Complications 1992;6:211–7.
85. Johnston B, Wheeler L, Deuser J, Sousa KH. Outcomes of the Kaiser Permanente Tele-Home Health Research Project. Arch Fam Med 2000;9: 40–5.
86. Dammacco F, Torelli C, Frezza E, Misuraca A, Perrotta P. Computer based instruction of diabetic children and adolescents. Techniques and results. J Endocrinol Invest 1989;12:141–2.
87. Dougherty GE, Soderstrom L, Schiffrin A. An economic evaluation of home care for children with newly diagnosed diabetes: results from a randomized controlled trial. Med Care 1998;36:586–98.
88. Mimura G. Summer camp. Diabetes Res Clin Pract 1994;24(suppl):S287–S290.
89. American Diabetes Association. Management of diabetes at diabetes camps. Diabetes Care 1999;22:167–9.
90. Pichert JW, Murkin SA, Snyder GM, Boswell EJ, Kinzer CK. Problem-based diabetes education using a video anchor. Diabetes Spectrum 1993;6: 160–4.
91. Pichert JW, Smeltzer C, Snyder GM, Gregory RP, Smeltzer R, Kinzer CK. Traditional vs anchored instruction for diabetes-related nutritional knowledge, skills, and behavior. Diabetes Educ 1994;20:45–8.
92. Pichert J, Snyder G, Kinzer C, Boswell E. Problem solving anchored instruction about sick days for adolescents with diabetes. Patient Educ Couns 1994;23:115–24.
93. Harkavy J, Johnson SB, Silverstein J, Spillar R, McCallum M, Rosenbloom A. Who learns what at diabetes summer camp. J Pediatr Psychol 1983;8: 143–53.
94. Kemp SF, Canfield ME, Kearns FS, Elders MJ. The effect of short-term intervention on long-term diabetes management. J Ark Med Soc 1986;83: 241–4.
95. Misuraca A, Di Gennaro M, Lioniello M, Duval M, Aloi G. Summer camps for diabetic children: an experience in Campania, Italy. Diabetes Res Clin Pract 1996;32:91–6.
96. Zimmerman E, Carter MC, Sears JH, Lawson JS, Howard CP, Hassanein RE. Diabetic camping: effect on knowledge, attitude, and self-concept. Issues Compr Pediatr Nurs 1987;10:99–111.
97. Smith KE, Schreiner BJ, Brouhard BH, Travis LB. Impact of a camp experience on the choice of coping strategies by adolescents with insulin-dependent diabetes mellitus. Diabetes Educ 1991;17:49–53.
98. Kaplan RM, Chadwick MW, Schimmel LE. Social learning intervention to promote metabolic control in type I diabetes mellitus: pilot experiment results. Diabetes Care 1985;8:152–5.
99. Massouh SR, Steele TM, Alseth ER, Diekmann JM. The effect of social learning intervention on metabolic control of insulin-dependent diabetes mellitus in adolescents. Diabetes Educ 1989;15:518–21.
100. Warzak WJ, Ayllon T, Delcher HK. Peer instruction of home glucose monitoring. Diabetes Care 1982;5:44–6.
101. McFarlane J, Hames CC. Children with diabetes. Learning self-care in camp. Am J Nurs 1973;73:1362–5.
102. Pichert JW, Meek JM, Schlundt DG, et al. Impact of anchored instruction on problem-solving strategies of adolescents with diabetes. J Am Diet Assoc 1994;94:1036–8.
103. Maryniuk MD, Kauwell GP, Thomas RG. A test of instructional approaches designed to influence food selection. Diabetes Educ 1986;12:34–6.
104. Lebovitz FL, Ellis GJ, Skyler JS. Performance of technical skills of diabetes management: increased independence after a camp experience. Diabetes Care 1978;1:23–6.
105. Robinson N, Bush L, Protopapa LE, Yateman NA. Employers' attitudes to diabetes. Diabet Med 1989;6:692–7.
106. Songer TJ, LaPorte RE, Corman JS, Orchard TJ, Becker DJ, Drash AL. Employment spectrum of IDDM. Diabetes Care 1989;12:615–21.
107. Heins JM, Arfken CL, Nord WR, Houston CA, McGill JB. The Americans with Disabilities Act and diabetes. Diabetes Care 1994;17:453.
108. Fisher JN. Diabetics need not apply. Diabetes Care 1989;12:659–60.
109. Simmons D, Fleming C, Cameron M, Leakehe L. A pilot diabetes awareness and exercise programme in a multiethnic workforce. N Z Med J 1996;109:373–6.
110. Reynolds WB. Health education for the diabetic. Occup Health Nurs 1978;26:7–14.
111. Burton WN, Connerty CM. Evaluation of a worksite-based patient education intervention targeted at employees with diabetes mellitus. J Occup Environ Med 1998;40:702–6.
112. LaPorte RE, Tajima N, Dorman JS, et al. Differences between blacks and whites in the epidemiology of insulin-dependent diabetes mellitus in Allegheny County, Pennsylvania. Am J Epidemiol 1986;123:592–603.
113. Gray D, Ingersoll G, Lawlor R, Golden M. Status of IDDM care in schools. Diabetes 1985;34:41a.
114. Jarrett L, Hillam K, Bartsch C, Lindsay R. The effectiveness of parents teaching elementary school teachers about diabetes mellitus. Diabetes Educ 1993;19:193–7.
115. Krier JJ. Involvement of educational staff in the healthcare of medically fragile children. Pediatr Nurs 1993;19:251–4.
116. Bradbury AJ, Smith CS. An assessment of the diabetic knowledge of school teachers. Arch Dis Child 1983;58:692–6.
117. Challen AH, Davies AG, Williams RJW, Baum JD. Support for families with diabetic children: parents' views. Practical Diabetes 1990;7:26–31.
118. Rewers M, LaPorte RE, King H, Tuomilehto J. Trends in the prevalence and incidence of diabetes: insulin-dependent diabetes mellitus in childhood. World Health Stat Q 1988;41:179–89.
119. Gesteland HM, Sims S, Lindsay RN. Evaluation of two approaches to educating elementary school teachers about insulin-dependent diabetes mellitus. Diabetes Educ 1989;15:510–3.
120. Glasgow RE, LaChance PA, Toobert DJ, Brown J, Hampson SE, Riddle MC. Long-term effects and costs of brief behavioural dietary intervention for patients with diabetes delivered from the medical office. Patient Educ Couns 1997;32:175–84.

Appendix A. Summary Evidence Tables

1. Diabetes Self-Management Education in Community Gathering Places

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Barnard J, et al.,[1] 1994 United States Before-and-after Least suitable Good quality	F/U: end of 26-day program n=652 Limitations: Details of intervention unclear	Type 2 59.4y 37.4% female NR	Residential (Pritikin) diet, exercise, and DSME program delivered by physicians, nutritionists, and exercise specialists for 26 days	Fasting blood glucose (mg/dL): Absolute change: –1.6 Relative change: –16.4% ($p < 0.001$, within) Total cholesterol (mg/dL): Absolute change: –1.4 Relative change: –22.0% ($p < 0.001$, within) LDL cholesterol (mg/dL): Absolute change: –0.9 Relative change: –22.0% ($p < 0.001$, within) HDL cholesterol (mg/dL): Absolute change: –0.1 Relative change: –12.2% ($p < 0.001$, within) Triglycerides (mg/dL): Absolute change: –1.0 Relative change: –33.1% ($p < 0.001$, within) Weight (kg): Absolute change: –4.4 Relative change: –5.1% ($p < 0.001$, within) Systolic blood pressure (mmHg): Absolute change: –8.6 Relative change: –6.6% ($p < 0.001$, within) Diastolic blood pressure (mmHg); Absolute change: –5.2 Relative change: –6.5% ($p < 0.001$, within)

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Brown SA & Hanis CL,[2] 1995 United States Before-and-after Least suitable Good quality	F/U: 3 months n=7 Limitations: Small sample size	Type 2 61y 60% female 100% Mexican American	Diabetes education program for self-care and self-monitoring of diabetes using videotapes and support groups	Glycated hemoglobin (%): Absolute change: –2.4 Relative change: –20.5% (p = 0.04, within) Fasting blood glucose (mg/dL): Absolute change: –73.2 Relative change: –36.8% (p = 0.04, within) Total cholesterol (mg/dL): Absolute change: +2.6 Relative change: +1.3% (p > 0.05, within) Triglycerides (mg/dL): Absolute change: –20.0 Relative change: –12.1% (p > 0.05, within) Weight (kg): Absolute change: –6.4 Relative change: –4.1% (p > 0.05, within) Knowledge: Relative change: +37.3% (p=0.04, within)
Brown SA, et al.,[3] 1998 United States Randomized trial Greatest suitability Fair quality	F/U: 6 and 12 months n=247 Limitations: Method of participant selection from registry unclear; no statistical testing; limited information on attrition other than class attendance; no baseline comparison	Type 2 54y 64% female 100% Mexican American	Diabetes education involving use of videotapes in Spanish on diet, physical activity, and complications; 12 weekly sessions for 3 months	12-month follow-up: Glycated hemoglobin (%): Absolute change: –1.7 Relative change: NR Fasting blood glucose (mg/dL): Absolute change: –18.9 Relative change: NR 6-month follow-up: Weight (lbs): Absolute change: –4.0 Relative change: NR

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Elshaw EB, et al.,[4] 1994 United States Randomized trial Greatest suitability Fair quality	F/U: 14 weeks n=152 Limitations: Sampling frame unclear; no mention of blinding assessor(s); attrition rate is 32%; no baseline comparison	Type 2 61y 70% female 100% Mexican American	Culturally-specific (Mexican American) 2-hour nutrition education sessions that involved 8 weekly video presentations followed by group discussion; delivered by an RN	Weight (lbs): Absolute change: Men: +0.3 Women: +2.1 Relative change: Men: +0.3% Women: +2.9% (men and women, p>0.05, between) Kilocaloric intake (per day): Absolute change: Men: +37.6 Women: –48.5 Relative change: Men: +1.1% Women: –2.5% (men and women, p>0.05, between) Cholesterol intake (mg, per day): Absolute change: Men: +132.2 Women: –5.0 Relative change: Men: + 32.2% Women: –3.7% (men and women, p>0.05, between)
Hahn JM, et al.,[5] 1998 United States Before-and-after Least suitable Fair quality	F/U: 6 months n=120 Limitations: No description of study population; time frame of intervention unclear; volunteer population not described; only 20% completed two lab tests	NR NR NR Predominantly African American	Four 2-hour educational sessions on healthy diet and food preparation; delivered by community volunteers	Glycated hemoglobin (%): Absolute change: –1.3 Relative change: –11.0% (p = 0.002, within) Total cholesterol (mg/dL): Absolute change: +6.0 Relative change: +2.7% (p = 0.110, within) HDL cholesterol (mg/dL): Absolute change: 0.0 Relative change: 0.0% (p = 0.399, within) LDL cholesterol (mg/dL): Absolute change: +7.0 Relative change: +4.8% (p = 0.108, within) Triglycerides (mg/dL): Absolute change: –2.0 Relative change: –1.3% (p = 0.406, within)

Appendix continued

Author, Year Location Study Design Suitability Study Quality	*Follow-up Interval n Limitations*	*Demographics: Type of Diabetes Mean Age Sex Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Heath GW, et al.,[6] 1991 Wilson R & Hoy W,[7] 1993 United States Retrospective cohort Moderate suitability Good quality	F/U: average of 50 weeks n=86 Limitations: Convenience sample of self-selected participants; variable follow-up intervals	Type 2 43y 79% white 100% Native American	I: Aerobic exercise sessions and biweekly lectures on physical activity and diet for a mean of 1.7 sessions per week for 37 weeks C: Did not participate in exercise program	Weight (kg): Absolute change: –3.2 Relative change: –4.0% ($p < 0.05$, between) Body mass index (kg/m^2): Absolute change: –1.1 Relative change: –3.6% ($p < 0.05$, between) Fasting blood glucose (mmol/L): Absolute change: –2.4 Relative change: –17.2% ($p < 0.05$, between) Glycated hemoglobin (%): Absolute change: –3.0 Relative change: –19.0% ($p > 0.05$, within)
Wang C-Y, et al.,[8] 1998 United States Before-and-after Least suitable Fair quality	F/U: 1y n=75 Limitations: Intervention not well described; sampling frame unclear; attrition not reported; number of participants with diabetes unclear	Type 2 71.8y 52% female 100% Chinese American	One education program and health assessment delivered by a diabetes nurse educator; health assessed biweekly for 1 year	Blood glucose (mg/dL): Absolute change: –57.9 Relative change: –29.2% ($p < 0.001$, within) Systolic blood pressure (mmHg): Absolute change: –12.3 Relative change: –7.9% ($p < 0.05$, within) Diastolic blood pressure (mmHg): Absolute change: –10.0 Relative change: –10.7% ($p < 0.05$, within)

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Wilson W, Pratt, C[9] & Pratt C, et al.,[10] 1987 United States Randomized trial Greatest suitability Fair quality	F/U: 8 and 16 weeks n=79 Limitations: Sampling frame unclear; validity of questionnaires unclear; clustering not taken into account; no baseline comparison of demographics	Type 2 68.2y 80% female NR	I-1: 1-hour group education and 1-hour unstructured class; delivered by a dietitian at senior centers, at 8, 12, and 16 weeks I-2: Same as I-1, plus peer support C: Usual care	Weight (lbs): I-1: Absolute change: 8w: –1.8 16w: –2.3 Relative change: 8w: –1.1% 16w: –1.4% (p>0.05, between) I-2: Absolute change: 8w: –6.1 16w: –5.6 Relative change: 8w: –0.4% 16w: –3.5% (p < 0.05, between) C: Absolute change: 8w: +0.6 Relative change: 8w: +0.4% (p > 0.05, between) Glycated hemoglobin (%): I-1: Absolute change: 8w: –2.4 16w: –1.3 Relative change: 8w: –3.9% 16w: –2.1% (p>0.05, between) I-2: Absolute change: 8w: –3.0 16w: –1.0 Relative change: 8w: –5.1% 16w: –1.7% (p>0.05, between) C: Absolute change: 8w: –0.7 Relative change: 8w: –1.2% (p > 0.05, between)

C, control group; DSME, diabetes self-management education; F/U, follow-up from end of baseline; HDL, high density lipoprotein; I, intervention group; LDL, low density lipoprotein; min, minutes; n, sample size; NR, not reported; w, weeks; y, year(s).

References

1. Barnard RJ, Jung T, Inkeles SB. Diet and exercise in the treatment of NIDDM. The need for early emphasis. Diabetes Care 1994;17:1469–72.
2. Brown SA, Hanis CL. A community-based, culturally sensitive education and group-support intervention for Mexican Americans with NIDDM: pilot study of efficacy. Diabetes Educ 1995;21:203–10.
3. Brown SA, Upchurch SL, Garcia AA, Barton SA, Hanis CL. Symptom-related self-care of Mexican Americans with type 2 diabetes: preliminary findings of the Starr County Diabetes Education Study. Diabetes Educ 1998;24:331–9.
4. Elshaw EB, Young EA, Saunders MJ, McGurn WC, Lopez LC. Utilizing a 24-hour dietary recall and culturally specific diabetes education in Mexican Americans with diabetes. Diabetes Educ 1994;20:228–35.
5. Hahn JM, Gordon DH. "Learn, taste, and share": a diabetes nutrition education program developed, marketed, and presented by the community. Diabetes Educ 1998;24:153–4,161.
6. Heath GW, Wilson RH, Smith J, Leonard BE. Community-based exercise and weight control: diabetes risk reduction and glycemic control in Zuni Indians. Am J Clin Nutr 1991;53(Suppl 6):1642S–1646S.
7. Wilson R, Hoy W. Short-term effects of participation in a community-based exercise program: a study in the pueblo of Zuni. IHS Primary Care Provider 1993;18:126–31.
8. Wang CY, Abbott LJ. Development of a community-based diabetes and hypertension preventive program. Public Health Nurs 1998;15:406–14.
9. Wilson W, Pratt C. The impact of diabetes education and peer support upon weight and glycemic control of elderly persons with noninsulin dependent diabetes mellitus (NIDDM). Am J Public Health 1987;77:634–5.
10. Pratt C, Wilson W, Leklem J, Kingsley L. Peer support and nutrition education for older adults with diabetes. J Nutr Elder 1987;6(4):31–43.

2. Diabetes Self-Management Education in the Home

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Basch C, et al.,[1] 1999 United States Randomized trial Greatest suitability Good quality	F/U: 6 months n=280 Limitations: None	Unclear 54.7y 65.7% female 100% white	I: Education about dilated eye exam: a low-literacy 9-page booklet, a motivational videotape, and telephone education; delivered by a health educator, 4 times in 6 months C: American Diabetes Association and American Dietetic Association meal planning booklet provided	Dilated eye examination in last 6 months: OR = +4.3 ($p < 0.05$, between)
Brown SJ, et al.,[2] 1997 United States Randomized trial Greatest suitability Fair quality	F/U: 6 months n=59 Limitations: Age and gender not compared between groups; potential "ceiling effect" bias for kids with good control; recall bias of parents	Type 1 14.2y NR NR	I: Educational video game for diabetes self-care; 34 hours over 6 months C: Alternative video game with no health-related content	Knowledge: Relative change: +3.0% ($p = 0.64$, between) Urgent visits (number visits per person in 6 months): Absolute change: –0.05 Relative change: –82.1% ($p = 0.08$, between) Hemoglobin A1c (%): Absolute change: +0.2 Relative change: +2.2% ($p = 0.67$, between)
Couper J, et al.,[3] 1999 Australia Non-randomized trial Greatest suitability Good quality	F/U: 18 months n=60 Limitations: Repeatedly measured knowledge with same tool	Type 1 14.2y 59.3% female NR	I: Home visits and phone calls for blood glucose, DSME, and goal setting by diabetes nurse educator; monthly home visits and weekly calls for 6 months C: Usual care (quarterly visits with pediatric endocrinologists)	Knowledge (patient): Relative change: 6m: +9.2% ($p = 0.001$, between) 12m: –0.5% ($p > 0.05$, between) 18m: –3.3% ($p > 0.05$, between) Knowledge (parent): Relative change: 6m: +11.1% ($p < 0.01$, between) 12m: + 8.7% ($p > 0.05$, between) 18m: + 4.0% ($p > 0.05$, between) Hemoglobin A1c (%): 6m: Absolute change: –1.2 Relative change: –10.7% ($p > 0.05$, between) 12m: Absolute change: –0.8% Relative change: –7.3% ($p > 0.05$, between) 18m: Absolute change: –1.1% Relative change: –9.9% ($p > 0.05$, between)

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Dougherty G, et al.,[4] 1999 Canada Randomized trial Greatest suitability Fair quality	F/U: 36 months n=63 Limitations: Intervention not well described; superior glycemic control may be due to nursing care	Type 1 9.3y 55.5% female NR	I: Home visits DSME; telephone and visit follow-up as needed; total of 58.9 hours over 2 years C: In-patient teaching; follow-up as needed	Knowledge: 24-month follow-up: Relative change: +7.9% ($p > 0.05$, between) Hemoglobin A1c (%; 36-month follow-up): Absolute change: – 1.5 Relative change: – 11.7% ($p < 0.02$, between)
Manning RM, et al.,[5] 1995 Scotland Randomized trial Greatest suitability Fair quality	F/U: 12 months n=205 Limitations: Interventions inadequately described; unclear analyses; no baseline comparison groups	Type 2 (73%) 55.7y 48.9% female NR	Four weight loss program interventions: I-1: Individual dietetic consultations at the diabetic center I-2: Behavioral therapy I-3: I-1 plus dexfenfluramine I-4: I-1 plus 2 home visits All programs delivered by physiotherapist, clinical psychologist, and dietitian; 7–10 visits over 12 months C: Usual care	Interventions combined vs controls at 12-month follow-up: Hemoglobin A1c (%): Absolute change: –0.6 Relative change: –9.5% ($p > 0.05$, within) Weight (kg): Absolute change: –2.3 Relative change: NR
Mazzuca KB, et al.,[6] 1997 United States Randomized trial Greatest suitability Fair quality	F/U: 16 and 32 weeks n=22 Limitations: Sampling frame unclear; assessor not blinded; repeatedly measured outcomes with same tool	Type 2 61y 77% female 45% white	I: Home visits for DSME: nutrition, exercise, care of feet, and blood glucose monitoring; delivered by community health nursing students; weekly or biweekly visits for 8 months C: Usual care	Blood glucose meter readings (mg/dL): 16-week follow-up: Absolute change: –43.4 Relative change: –21.3% ($p > 0.05$, within) 32-week follow-up : Absolute change: –56.0 Relative change: –28.3% ($p > 0.05$, within) Self-care behaviors: 32-week follow-up: Relative change: +12.1% ($p = 0.003$, within)
Rettig BA, et al.,[7] 1986 United States Randomized trial Greatest suitability Good quality	F/U: 12 months n=471 Limitations: Type of diabetes, number of visits per patient, and duration of intervention all unclear	Unclear 51y 66% female 91% white	I: Individual home visits with education based on needs assessment; delivered by an RN/LPN for $\leq$12 visits C: Usual care	Knowledge: Relative change: +16.7% ($p = 0.001$, between) Skills (score): Relative change: +3.0% ($p = 0.04$, between) Foot appearance (score): Relative change: +1.9% ($p > 0.05$, between) ER visits (count/person in last 6 months): Absolute change: –0.02 Relative change: –25.0% ($p > 0.05$, between)

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Turnin M-CG, et al.,[8] 1992 France Randomized trial Greatest suitability Fair quality	F/U: immediate and 12 months n=104 Limitations: No description of sampling frame; biased exclusion of patients from analysis; unclear validity of dietetic knowledge questionnaire; no blinding of assessor; high attrition rate (76%) at 18 month follow-up	Mixed 45y 42% female NR	I: DSME by a computer-based system that provides individualized dietary counseling and general information; delivered 6 times per month for 6 months C: Not described	Dietetic knowledge (12-month follow-up): Relative change: +8.9% ($p < 0.005$, within) Hemoglobin A1c (12-month follow-up): Absolute change: –0.2% Relative change: –2.0% ($p < 0.001$, within) Weight (kg) (immediate follow-up): Absolute change: 0.0 ($p > 0.05$, within) Relative change: NR
Whitlock WL, et al.,[9] 2000 United States Randomized trial Greatest suitability Good quality	F/U: ≤1 month from end of I n=28 Limitations: Use of recommended educational classes by controls not reported	Type 2 63y 64% female NR	I: Home telemedicine delivered by nurse case manager and primary care physicians C: Routine care	Hemoglobin A1c (%): Absolute change: –0.4 Relative change: –4.2 % ($p < 0.05$, within) Mean weight (lbs): Absolute change: –10.0 Relative change: –4.6% ($p < 0.05$, within)
York R, et al.,[10] 1997 United States Randomized trial Greatest suitability Fair quality	F/U: 8 w postpartum n=96 Limitations: Population included persons with diabetes and hypertension; unclear number of persons with with diabetes; accessible population unclear	Gestational 27y 100% female 18% white	I: Hospital DSME, discharge followed by home visits and weekly telephone support; delivered by perinatal nurse specialist C: Regular discharge criteria, no home care	Rehospitalization for glucose control (number of patients): Absolute change: –5.0 ($p = 0.048$, between) Relative change: NR Birth weight (lbs): Absolute change: +0.8 ($p = 0.09$, between) Relative change: NR Gestational age (weeks): Absolute change: +1.0 ($p = 0.054$, between) Relative change: NR

C, control group; DSME, diabetes self-management education; ER, emergency room; F/U, follow-up from end of baseline; I, intervention or intervention group; LPN, licensed practical nurse; m, months; n, sample size; NR, not reported; OR, odds ratio; RN, registered nurse; w, weeks; y, year(s).

Appendix continued

References

1. Basch CE, Walker EA, Howard CJ, Shamoon H, Zybert P. The effect of health education on the rate of ophthalmic examinations among African Americans with diabetes mellitus. Am J Public Health 1999;89:1878–82.
2. Brown SJ, Lieberman DA, Germeny BA, Fan YC, Wilson DM, Pasta DJ. Educational video game for juvenile diabetes: results of a controlled trial. Med Inform 1997;22:77–89.
3. Couper J, Taylor J, Fotheringham M, Sawyer M. Failure to maintain the benefits of home-based intervention in adolescents with poorly controlled type 1 diabetes. Diabetes Care 1999;22:1933–7.
4. Dougherty G, Schiffrin A, White D, Soderstrom L, Sufrategui M. Home-based management can achieve intensification cost-effectively in type I diabetes. Pediatrics 1999;103:122–8.
5. Manning RM, Jung RT, Leese GP, Newton RW. The comparison of four weight reduction strategies aimed at overweight diabetic patients. Diabet Med 1995;12:409–15
6. Mazzuca KB, Farris NA, Mendenhall J, Stoupa RA. Demonstrating the added value of community health nursing for clients with insulin-dependent diabetes. J Community Health Nurs 1997;14:211–24.
7. Rettig BA, Shrauger DG, Recker RR, Gallagher TE, Wiltse H. A randomized study of the effects of a home diabetes education program. Diabetes Care 1986;9:173–8.
8. Turnin MC, Beddok RH, Clottes JP, et al. Telematic expert system Diabeto: New tool for diet self-monitoring for diabetic patients. Diabetes Care 1992;15:204–12.
9. Whitlock WL, Brown A, Moore, K. Telemedicine improved diabetic management. Mil Med 2000;165:579–84.
10. York R, Brown LP, Samuels P, et al. A randomized trial of early discharge and nurse specialist transitional follow-up care of high-risk childbearing women. Nurs Res 1997;46:254–61.

3. Diabetes Self-Management Education in the Camp Setting

Author, Year Location Study Design Suitability Study Quality	Follow-up Interval n Limitations	Demographics: Type of Diabetes Mean Age Sex Race/Ethnicity	Intervention	Results: Summary Effect Measures, p-value, within or between groups
Harkavy J, et al.,[1] 1983 United States Before-and-after Least suitable Good quality	F/U: 2 weeks n=93 Limitations: Attendance rate not measured	Type 1 13.2y 52% female 82% white	2-week diabetes summer camp with daily formal and informal education (knowledge and skills); delivered by a physician, an RN, and trained counselors	Knowledge: Relative change: +5.0% ($p < 0.01$, within) Problem solving: Relative change: +7.2% ($p < 0.002$, within)
Kaplan RM, et al.,[2] 1985 United States Randomized trial Greatest suitability Fair quality	F/U: 4 months n=21 Limitations: Sampling frame unclear; volunteer study population; follow-up comparison did not take into account baseline hemoglobin A1c	Type 1 14.9y 62% female 100% white	I: Diabetes summer camp program based on social learning theory (discussions, videos, & film); delivered by a psychology graduate student, an endocrinologist, an ophthalmologist, and a podiatrist, daily for 3 weeks C: Usual summer camp program	Hemoglobin A1c (%): Absolute change: –1.8 Relative change: –13.8% ($p < 0.05$, between)
Kemp SF, et al.,[3] 1986 United States Before-and-after Least suitable Fair quality	F/U: immediate n=42 Limitations: No description of sex, race, or duration of diabetes; unclear who delivered education session; unclear sampling frame; attendance rate not measured; unclear validity of knowledge questionnaire; unclear use of subsample analyses for glycated albumin; unclear how subsample selected	Type 1 10y NR NR	DSME for 8 hrs during 10-day camp	Glycated albumin (%): Absolute change: 1983: –2.0 1984: –2.7 Relative change: 1983: –12.1% ($p < 0.0001$, within) 1984: –16.2% ($p < 0.0002$, within) Knowledge: Relative change: 1984: +14.2% ($p < 0.0001$, within)
Massouh SR, et al.,[4] 1989 United States Randomized trial Greatest suitability Fair quality	F/U: 3.5 months n=33 Limitations: Unclear sampling frame; inconsistent reporting on number of subjects	Type 1 13y 55% female 100% white	I: Daily 1-hour education program followed by social learning intervention and role-modeling with observation of peers' behaviors; delivered by a therapist for 40 minutes daily for 8 days C: Daily 1-hour education only	Hemoglobin A1c (%): Absolute change: +0.3 Relative change: +2.8% ($p = 0.008$, within)

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Misuraca A, el al.,[5] 1996 Italy Before-and-after Least suitable Fair quality	F/U: 3 months n=256 Limitations: No description of subject allocation into type of education received; use of subsamples in the analyses without explanation of how selected; no information on knowledge questionnaire; no control of clustering	Type 1 10y 53% female NR	I-1: DSME and monthly follow-up meetings after camp I-2: Computer program education delivered by pediatric endocrinologists, psychologists, and nurses throughout the 10-day camp, and then monthly	Knowledge: Relative change: I-1: +93.1% ($p < 0.01$, within) I-2: +47.2% ($p < 0.01$, within) Hemoglobin A1c (%): Absolute change: –3.8 Relative change: –35.5% ($p < 0.01$, within)
Pichert JW, et al.,[6] 1994 United States Randomized trial Greatest suitability Fair quality	F/U: 2–6 days n=83 Limitations: No description of gender and race; potential contamination of control group; group-specific data not reported	Type 1 12.3y NR NR	I: Nutritional education with problem-solving instruction and video presentation; delivered by a nurse educator and a dietitian in 4 small group sessions over 2 weeks C: Nutrition lectures, memory drills, hands-on exercises, and meal planning	Knowledge: No data to calculate % change
Pichert JW, et al.,[7] 1994 United States Randomized trial Greatest suitability Fair quality	F/U: 7 days n=84 Limitations: Mean age and race not reported; 28% attrition rate; no baseline comparison; exact data values not reported	Type 1 NR (range 9–15y) 52% female NR	I: Instruction on and use of guidelines for sick-day diabetes management, 45-min medical education and problem-solving instruction; in 4 sessions, over 1 week C: Same as I, without problem-solving instruction	Knowledge: Relative change: +7.4% ($p = 0.27$, between)
Pichert JW, et al.,[8] 1993 United States Randomized trial Greatest suitability Fair quality	F/U: 4–6 days n=64 Limitations: Mean age and race not reported; questionnaire short answer items not validated; controls were exposed to information more frequently; potential contamination of controls	Type 1 NR (range 10–15y) 44% female NR	I: A nurse-led intervention focused on problem-solving instruction via videodisc, plus 3 educational sessions for 45 minutes, over 2 weeks C: Four didactic sessions	Knowledge about exercise (number correct): Older group (mean age 13.1y): Relative change: +11.9% ($p > 0.05$, between) Younger group (mean age 10.5y): Relative change: +20.2% ($p > 0.05$, between)

Appendix continued

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Smith KE, et al.,[9] 1991 United States Before-and-after Least suitable Good quality	F/U: Immediate n=108 Limitations: Self-selected population; coping strategies that may have been influenced by stress situations	Type 1 14.5y 56% female 96% white	A stress-management curriculum (relaxation, imagery, physical exercise, problem-solving, and cognitive approaches) implemented at a summer camp by medical education staff; daily 1-hour sessions during a 7-day camp	Coping strategies: Relative change: +3.6% ($p > 0.05$, within)
Zimmerman E, et al.,[10] 1987 United States Before-and-after Least suitable Fair quality	F/U: 6 days n=81 Limitations: No description of mean age, gender, or race; no description of education method; unclear sampling frame	Type 1 8–14y NR NR	Diabetes education delivered by student nurses; daily sessions, for 1 week	Knowledge: Relative change: +12.1% ($p > 0.05$, within) Self-concept: Relative change: +1.5% ($p > 0.05$, within)

C, control group; DSME, diabetes self-management education; F/U, follow-up from baseline; I, intervention group; n, sample size; NR, not reported; y, year(s).

References

1. Harkavy J, Johnson SB, Silverstein J, Spillar R, McCallum M, Rosenbloom A. Who learns what at diabetes summer camp. J Pediatr Psychol 1983;8:143–53.
2. Kaplan RM, Chadwick MW, Schimmel LE. Social learning intervention to promote metabolic control in type I diabetes mellitus: pilot experiment results. Diabetes Care 1985;8:152–5.
3. Kemp SF, Canfield ME, Kearns FS, Elders MJ. The effect of short-term intervention on long-term diabetes management. J Ark Med Soc 1986;83:241–4.
4. Massouh SR, Steele TM, Alseth ER, Diekmann JM. The effect of social learning intervention on metabolic control of insulin-dependent diabetes mellitus in adolescents. Diabetes Educ 1989;15:518–21.
5. Misuraca A, Di Gennaro M, Lioniello M, Duval M, Aloi G. Summer camps for diabetic children: an experience in Campania, Italy. Diabetes Res Clin Pract 1996;32:91–6.
6. Pichert JW, Smeltzer C, Snyder GM, Gregory RP, Smeltzer R, Kinzer CK. Traditional vs anchored instruction for diabetes-related nutritional knowledge, skills, and behavior. Diabetes Educ 1994;20:45–8.
7. Pichert J, Snyder G, Kinzer C, Boswell E. Problem solving anchored instruction about sick days for adolescents with diabetes. Patient Educ Couns 1994;23:115–24.
8. Pichert JW, Murkin SA, Snyder GM, Boswell EJ, Kinzer CK. Problem-based diabetes education using a video anchor. Diabetes Spectrum 1993;6:160–4.
9. Smith KE, Schreiner BJ, Brouhard BH, Travis LB. Impact of a camp experience on the choice of coping strategies by adolescents with insulin-dependent diabetes mellitus. Diabetes Educ 1991;17:49–53.
10. Zimmerman E, Carter MC, Sears JH, Lawson JS, Howard CP, Hassanein RE. Diabetic camping: effect on knowledge, attitude, and self-concept. Issues Compr Pediatr Nurs 1987;10:99–111.

4. Diabetes Self-Management Education at the Worksite

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Burton, WN & Connerty, CM,[1] 1998 United States Before-and-after Least suitable Fair quality	F/U: 3 months n=53 Limitations: Accessible population not reported; statistical tests not described	Mixed 45.4y 52% female NR	Five monthly 1-hour education sessions on care; delivered by a certified diabetes educator	Fasting blood glucose (mg/dL): Absolute change: –18.2 Relative change: –9.2% (p = 0.12, within) Glycated hemoglobin (%): Absolute change: –1.4 Relative change: –12.2% (p < 0.001, within) Hemoglobin A1c (%): Absolute change: –0.7 Relative change: –7.8% (p < 0.001, within)

F/U, follow-up from baseline; n, sample size; NR, not reported; y, year(s).

Reference

1. Burton WN, Connerty CM. Evaluation of a worksite-based patient education intervention targeted at employees with diabetes mellitus. J Occup Environ Med 1998;40:702–6.

5. Education of School Personnel About Diabetes

Author, Year *Location* *Study Design* *Suitability* *Study Quality*	*Follow-up Interval* *n* *Limitations*	*Demographics:* *Type of Diabetes* *Mean Age* *Sex* *Race/Ethnicity*	*Intervention*	*Results: Summary Effect Measures, p-value, within or between groups*
Jarrett J, et al.,[1] 1993 United States Before-and-after Least suitable Fair quality	F/U: 6–8 weeks n=49 families Limitations: No description of parent or teacher demographics; sampling frame and inclusion criteria unclear; 31% non-response rate	NR NR NR NR	Parents educated teachers on care of children with diabetes; one session, for 20–30 minutes	Teacher knowledge of hypoglycemic symptoms: Relative change: +43% ($p < 0.001$, within) Teacher knowledge of hyperglycemic symptoms: Relative change: –7.1% ($p > 0.05$, within)

F/U, follow-up from baseline; n, sample size; NR, not reported.

Reference

1. Jarrett L, Hillam K, Bartsch C, Lindsay R. The effectiveness of parents teaching elementary school teachers about diabetes mellitus. Diabetes Educ 1993;19:193–7.

Reprinted by permission of Elsevier Science from:
Increasing diabetes self-management education in community settings: a systematic review. Norris SL, Nichols PJ, Caspersen CJ, Glasgow RE, Engelgau MM, Jack Jr. L, Snyder SR, Carande-Kulis VG, Isham GJ, Garfield S, Briss P, McCulloch D, Task Force on Community Preventive Services., American Journal of Prevention Medicine. Vol 22 No 4S, pp 39-66.